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Assessing the Competency Readiness of Mechanical Executives in the Sewerage Industry

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Abstract

In the era of globalization, the sewerage industry plays an important role in ensuring environmental sustainability. However, a major challenge is the skills mismatch between university graduates and industry needs. Therefore, this study is significant because graduate skills play a crucial role in meeting industry needs, especially in the sewerage sector. By understanding the level of competence and skills that should be focused on for mechanical engineering graduates and mechanical engineering technology students, the development of job structures related to the sewerage industry can be improved from the outset. This study employs a quantitative approach using the survey method. A total of 189 samples representing the Universiti Tun Hussein Onn Malaysia and Universiti Teknikal Melaka were selected using a simple random sampling technique, and their findings were analysed descriptively. All research data obtained was analysed using SPSS software to obtain frequency values, mean scores, percentages, standard deviations, and analyses of differences between the two program groups. The result of descriptive statistics analysis (mean) indicates a high level of the existing knowledge competency, basic skills competency behavioural attitude, and habitual behaviour. Results of Mann-Whitney U test indicate a significant difference in the technical skill levels between mechanical engineering and mechanical engineering technology students with higher technical skills among the mechanical engineering programs. This study is expected to provide useful input for policymakers, educational institutions, and the sewerage industry, and help address the issue of unemployment and skill mismatch in Malaysia as a whole.

1. Introduction

Skill mismatch has been quiet an issue that need to be address in any industry in any country to align with the technological changes of industrial revolution and produce the high skill workers. Despite, the sewerage sector specifically for mechanical students' skills has been investigated at the least possible way. In recent times, the

difficulty of finding a job among new graduates has caused concern for students still studying at higher education institutions (Yusof Husain et al., 2017). Most industries in Malaysia require workers with specialized technical skills, such as those in the manufacturing and construction sectors. Several factors contribute to graduates not meeting industry needs, including work experience, graduate skills, and the quality of education (Hanapi & Nordin, 2014; Mohd Azri et al., 2019). This aligns with data from the Kementerian Pengajian Tinggi, (2022), which shows that only 85.5% of graduates were employable in 2021, meaning 14.5% (41,514 individuals) had not yet found employment. Furthermore, graduates in engineering, manufacturing, and construction studies recorded an 11.4% unemployment rate (8,964 individuals), highlighting the problem of unemployment and the difficulty of finding a job among new graduates, especially in the post-pandemic phase.

Quality education can provide students with the understanding and skills they need before entering the job market and becoming efficient in their work (Kenayathulla et al., 2019). However, if the education system fails to provide holistic skills and knowledge, it can lead to high unemployment rates. According to Mokhtar et al., (2021), failing to provide a syllabus or curriculum that aligns with market needs weakens the quality of education and makes it difficult to secure employment. Relevant work experience is often a key factor in determining a person's marketability and plays a crucial role in addressing unemployment issues (Jiménez López et al., 2022). In line with Kapareliotis et al., (2019), employers may prefer to recruit applicants with relevant professional experience, at least with industrial training, due to cost efficiency and faster contributions to the organization.

A previous survey found an imbalance between the knowledge and skills of TVET graduates and what is needed in the job market, based on industry feedback (Ridzwan et al., 2017). This imbalance can lead to an increase in low-skilled or semi-skilled workers compared to high-skilled workers in Malaysian industries each year, even before the COVID-19 pandemic (Department of Statistics Malaysia, 2020). Stakeholder initiatives such as the KPT Career Development Generator Program, Teaching Factory, and Technical and Vocational Education Transformation (TVET) aim to produce holistic, balanced graduates suitable for industry needs and to address the skills imbalance. These initiatives focus on deepening knowledge, skills, behavior, and habitual behavior, which are essential for sustainable career prospects.

In the workplace, four main characteristics determine the quality of team members: knowledge, skills, behavior, and habitual behavior. All these aspects can influence individual performance and contribute to organizational success and productivity (Wider et al., 2023). However, many organizations primarily select employees based on basic knowledge and skills, neglecting the importance of personality elements (R. Kotur & Anbazhagan, 2014). Aspects of employee behavior and habitual behavior help employees adapt to situations or problems within an organization. Inability to adapt can lead to job-hopping, a common issue among Generation Z in Malaysia. According to Zahari and Puteh (2023), interpersonal relationships closely related to behavior and habitual behavior influence the desire to switch jobs. Therefore, it is crucial for students or job seekers to strengthen not only knowledge and basic skills but also personality elements, incorporating behavior and habitual behavior into their daily lives.

There is a conceptual difference between engineering technology graduates and engineering graduates, but in the job market, tasks and opportunities overlap, especially for level five workers, such as engineers and executives (bachelor's graduates). Engineering education focuses more on theory and planning, while engineering technology emphasizes the application of technology in work processes (Haslina Hassan, 2023). Despite similar opportunities, job acquisition difficulty remains a concern for first-degree graduates, with a 15.5% unemployment rate (121,751 individuals) among 2021 graduates, including 11.4% (8,950 individuals) from the engineering field (Ministry of Higher Education, 2022). This has led to graduates working outside their field, which is detrimental to applying their knowledge and experience.

Lack of skills impacts the environment, as outdated technology and unskilled workers in the sewerage sector contribute to sewage pollution, especially in the era of Industrial Revolution 4.0 (Ariffin & Sulaiman, 2015). Limited participation from young workers and facility constraints hinders environmental conservation efforts (Ministry of Human Resources, 2023). This issue is closely related to the Sustainable Development Goals target, SDG 6, which aims for clean water and sanitation (UNESCO, 2021). Without skilled workers to operate advanced technology, efforts to address water pollution from sewage waste are hampered. The increase in sewerage sector workers, whether skilled, semi-skilled, or low-skilled, reflects the sector's development in Malaysia (SPAN, 2013, 2022). According to the Ministry of Human Resources (2023), the sewerage sector urgently needs workers with strong technical abilities and comprehensive Interpersonal skills, covering all aspects from sewage waste reception to discharge.

Therefore, Malaysian education should emphasize technical and vocational fields to create skilled and knowledgeable graduates aligned with the goals of Industrial Revolution 4.0 (Roy & Marsafawy, 2023). Engineering and TVET students must master employability skills, which are not tied to specific technical knowledge but include communication, time management, creative and critical thinking, and teamwork skills. According to Ruslan et al. (2023), although TVET students have high knowledge in construction work, their basic environmental knowledge and skills are lacking, challenging Malaysia's goals of being an environmentally friendly country. Ndlovu and Van Wyk (2023) also emphasize that competency in interpersonal skills can enhance

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employees' technical expertise, a concern in South Africa. Comprehensive human capital development, including personality, intellect, and skills, is essential to keep pace with national development and progress. Graduates and students must prepare for these changes to compete effectively in the increasingly challenging era of the industrial revolution.

Based on the background of the problem, several issues have been discussed related to the needs of the sewerage industry that are not met by new graduates, especially mechanical engineering graduates. Most employers require candidates to have relevant work experience in addition to their academic qualifications. According to Mokhtar et al. (2021), hiring is often based on work experience alongside graduate skills, as these factors significantly increase the probability of being called for employment. Recently, there has been a growing emphasis on developing graduate skills that align with industry needs, particularly through the government's approach to empowering TVET. Among the main skills that graduates need are employability skills, such as problem-solving and interpersonal skills, as well as related competencies and skill improvement (Markes, 2018). However, the question remains whether new graduates, especially in engineering, are prepared to face the work pressure or challenges in the sewerage sector, which is considered a 3-D job—dirty, difficult, and dangerous. Therefore, this study will be significant in examining how graduate skills meet the needs of the industry, particularly in the sewerage sector. By understanding the level of competence and skills required for mechanical engineering graduates and mechanical engineering technology students, this study aims to improve the development of job structures related to the sewerage industry from the very beginning. This study aims to answer the following research questions.

a) What is the level of existing knowledge of mechanical students for working as mechanical executives in the sewerage sector?
b) What is the basic skill level required for mechanical students to work as mechanical executives in the sewerage sector?
c) What is the level of behavioural attitude towards mechanical students working as mechanical executives in the sewerage sector?
d) What is the level of habitual behaviour towards mechanical students working as mechanical executives in the sewerage sector?
e) Is there a difference in technical skills between students of mechanical engineering and mechanical engineering technology for working as mechanical executives in the sewerage sector?
f) Is there a difference in interpersonal skills between students of mechanical engineering and mechanical engineering technology for working as mechanical executives in the sewerage sector?

2. Methodology

This study utilizes a quantitative approach, employing a survey design research methodology to systematically gather and analyze data on the competence levels of mechanical engineering and engineering technology students, particularly regarding their ability to meet job demands as mechanical executives in the sewerage sector during the Industrial Revolution 4.0 era. This research was conducted via a survey targeting students from the Malaysian Technical University Network (MTUN) in the southern zone, involving two universities: Universiti Tun Hussein Onn Malaysia in Johor and Universiti Teknikal Malaysia Melaka. The study population comprised final-year students who have completed most of their academic coursework. The selection of MTUN aligns with its mission to educate and train highly skilled human resources to contribute to the country's advanced industries. The study aims to evaluate the extent of student competence in both interpersonal and technical skills, with a focus on careers in the sewerage sector. A quantitative approach was employed to collect and analyze data, using questionnaires as the primary instrument to achieve the study's objectives. Before distributing the questionnaire to the 189 participants determined by the Krejcie and Morgan table (1970) (Table 1) for the appropriate sample size based on the population, the researcher developed the research instrument grounded in a conceptual framework derived from pertinent theories and frameworks related to the research problem. This instrument also incorporates analysis from previous studies deemed significantly related to the competencies of mechanical executives in the sewerage sector. The Statistical Package for the Social Sciences (SPSS) was utilized as a tool to facilitate the data analysis process after the survey, enabling the extraction and analysis of the collected information.

Table 1 *Sample size based on the student population*

Bil	MTUN University	Students Population	Sample Size
1	Universiti Tun Hussein Onn Malaysia Mechanical Engineering Students Mechanical Engineering Technology Students	120 115	189

	Universiti Teknikal Malaysia, Melaka		
2	Mechanical Engineering Students		73
	Mechanical Engineering Technology Students		65
		Total	373

2.1 Research Instrument

A survey of the sewer sector mechanical executive competency has four main dimensions which are B: Respondent Existing Knowledge, C: Respondent Basic Skills, D: Respondent Attitude and E: Respondent Habit. The researcher has adapted various competency model including Iceberg Model of competence, Spencer's Competency Theory, and illustrated well in Figure 1. The technical skill is subdivided into existing knowledge and basic skills while interpersonal skills is subdivided into behavioural attitude and habitual behaviour to be align with research question. Related item of those dimensions has been constructed align with the Malaysian Assessment Skills Framework and Industrial Skills Framework for the related sewerage industry that could be applicable to the engineering student of MTUN specifically.

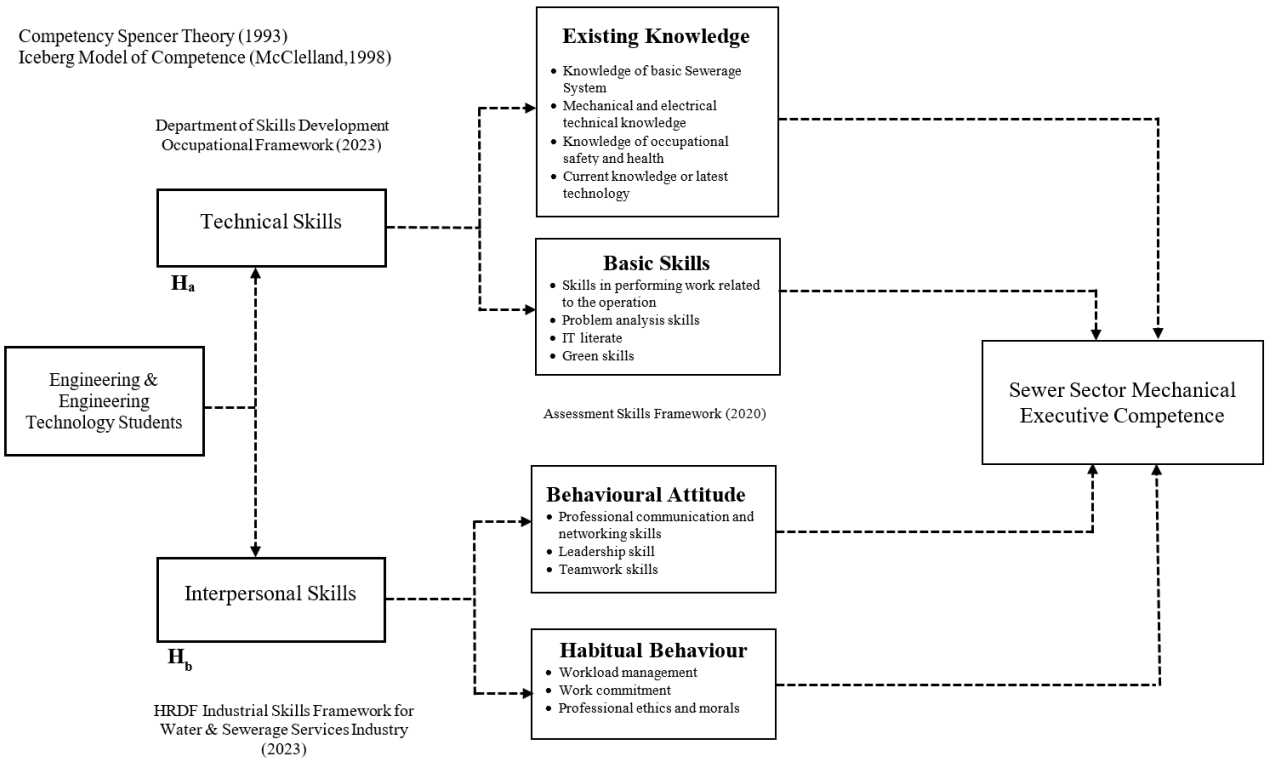

Fig. 1 *Research conceptual framework*

The pilot study had been done as an improvement process for the structure of the instrument, enhancing its content and items to ensure that data collection can be carried out with a high level of reliability. For this research, the application of Rasch Measurement Model approach is applied to the constructed item to get much more reliable to the newly developed based on the theoretical model improvements. According to Amirrudin et al. (2020), a sample size of 30 respondents is sufficient for the researcher to conduct the pilot test. The distribution of constructed items and emendations after pilot study are as follows in Table 2.

Table 2 *Constructed survey instrument items*

Construct	Items	Constructed Item	Emendation Item
B: Respondent Existing Knowledge	B1 – B17	17	14
C: Respondent Basic Skills	C1 – C18	18	17

D: Respondent Attitude	D1 – D14	14	11
E: Respondent Habit	E1 – E14	14	10
	Total Items	63	52

3. Results and Discussion

The collected data were analysed to determine mean scores and T-test values, all aimed at achieving the primary research objectives. The analysis aimed to assess the competency levels across various dimensions among mechanical students for their roles as mechanical executives in the sewerage sector, and to compare differences between the mechanical engineering and mechanical engineering technology programs.

3.1 Core Competency Analysis

Essentially, descriptive analysis was used to answer the research questions to determine the level of technical skills, including existing knowledge and basic skills of mechanical students. Additionally, Interpersonal skills, which encompass the behaviour and habitual actions of these students in working as mechanical executives in the sewerage sector, were also analysed using descriptive analysis. Based on Table 3, all constructs in the competency as mechanical executives in the sewerage sector are at a high level. This means that their overall competency is high for working as mechanical executives in the sewerage sector among engineering and mechanical engineering technology students at the Malaysian Technical University Network (MTUN), as summarized in Table 3.

3.1.1 Core Competency Analysis Based on Existing Knowledge

In this study, the researcher developed 14 items to assess respondents' existing knowledge of mechanical executives' competencies in the sewerage sector. As shown in Table 4, the results indicate that students at MTUN have a high level of knowledge, with an average score of 4.11.

Table 4 *Level of competency based on student existing knowledge*

Item	Statement	Mean Score	Level
B1	I know the impact of the sewerage system on the environment.	3.69	High
B2	I understand the basic process of wastewater treatment and its applications in daily life.	3.66	Moderate
B3	I am aware of the national target for Sustainable Development Goal 6, which is Clean Water and Sanitation.	3.41	Moderate
B4	I understand the drainage system types, including pipe types and material selection in sewerage.	4.07	High
B5	I am familiar with electrical equipment types such as Sensors, Motor Switches, or actuators and their essential functions.	4.31	High
B6	I understand energy efficiency usage in an electrical system.	4.36	High
B7	I understand the correct mechanical and electrical work procedures.	4.33	High
B8	I understand workplace safety standards in the industry (Chemical Handling, Work Environment).	4.32	High
B9	I know how to assess potential risks and necessary control measures.	4.31	High
B10	I understand that workers should only work based on their technical and physical capabilities.	4.32	High
B11	I can apply the latest technology such as robotic equipment or 3D printing in problem-solving.	4.25	High
B12	I understand the latest automation systems such as hydraulic, pneumatic sensors, or Simulation Technology to improve operational efficiency.	4.26	High
B13	I know how to use Artificial Intelligence (AI) in daily life.	4.11	High
B14	I can use a variety of technological sources without relying on just one source.	4.17	High
	Average Mean Score	4.11	High

The highest average score is for item B9, "I understand the use of energy efficiency in an electrical system," with a score of 4.35. The second highest score is for item B10, "I understand mechanical and electrical work

procedures correctly," with an average score of 4.33. The lowest average score is for item B5, "I am aware of the country's target for Sustainable Development Goal 6, which is Clean Water and Sanitation," with a score of 3.41. The second lowest is item B2, "I know the basic processes of wastewater treatment and their application in daily life," with an average score of 3.66.

Although the study sample is from the field of mechanical engineering, these students are aware of the importance of mastering various disciplines, particularly in the context of electrical engineering. This is because mechanical programs in Malaysia typically have a very structured and comprehensive curriculum (Jumaidin et al., 2023; Shahruddin Mahzan et al., 2021). According to Ridzwan et al. (2017), it is important for graduates in technical fields to master a variety of disciplines because the current job market or industry does not focus solely on one field of knowledge. This ability to adapt and contribute effectively to various industries is crucial. Additionally, SPAN (2022) outlines those electrical and mechanical elements must work in tandem within a sewerage system, highlighting the importance of mastering both disciplines. Through a comprehensive educational approach and significant practical experience, these mechanical students will be better prepared to face challenges in the engineering world and make meaningful contributions to the industry and society. Furthermore, there are two items related to existing knowledge that are at a moderate level but still hold a good and positive position. These items relate to the mechanical students' understanding of Sustainable Development Goal 6, which is Clean Water and Sanitation, and the basic processes of wastewater treatment and their application in daily life. Although awareness of the importance of SDGs is increasing, not all subjects in the mechanical field have fully integrated these topics into their curriculum. Courses specifically on sustainability or SDGs might only be electives or additions, rather than core components of the program (Jumaidin et al., 2023). Therefore, students' knowledge and awareness of SDGs need to be enhanced to better prepare them to contribute to sustainability through their careers in mechanical engineering."

3.1.2 Core Competency Analysis Based on Basic Skills

The researcher developed 17 items to assess respondents' basic skills in mechanical executive competencies in the sewerage sector. As shown in Table 5, the analysis indicates that students at MTUN have a high level of knowledge, with an average score of 4.11. The highest score is for item C18, "I always practice water-saving measures continuously, either at work or at home," with an average score of 4.48. The second-highest score is for item C3, "I will perform mechanical equipment calibration well according to the instruction manual if given," with an average score of 4.30. The lowest score is for item C14, "I am proficient in using suitable software for data analysis such as SPSS, MATLAB, Abaqus, or Finite Element Method (FEM) software," with an average score of 3.75. The second-lowest scores are for items C15 and C12, which are "I can apply Industrial Revolution 4.0 elements, particularly the Internet of Things (IoT), in problem-solving," and "I will solve problems in an environmentally friendly manner, such as using renewable energy," both with an average score of 3.87.

The analysis shows that the technical skills of mechanical students are at a high level. They demonstrate strong proficiency in fields such as electrical engineering compared to purely mechanical skills. However, there should be more emphasis on green skills practices, Industrial Revolution elements, the Internet of Things (IoT), and data analysis skills using software to prepare mechanical students for executive roles in the sewerage sector. Their basic mechanical engineering skills are strong, as they can perform equipment calibration well with instruction manuals. This is because mechanical programs in Malaysia offer a structured and comprehensive curriculum that combines academic knowledge with diverse industrial experience, providing practical perspectives to students (Jumaidin et al., 2023; Shahruddin Mahzan et al., 2021). Each course is designed to impart in-depth knowledge and skills in the field as well as related areas. The green skills of mechanical students are at a high level, but they need more emphasis since some basic skills, especially in environmentally friendly problem-solving like using renewable energy sources such as wind, solar, biomass, or hydroelectric power, are among the lowest. Green skills might still be a new and less familiar concept in Malaysia (Falsafah et al., 2018)., which is why students might not fully understand their importance or practical application.

Table 5 *Level of competency based on student basic skills*

Item	Statement	Score Mean	Level
C1	I can operate machines/equipment according to the manual carefully and perfectly.	4.02	High
C2	I can perform maintenance and preservation of mechanical assets/equipment well.	4.21	High
C3	I can carry out calibration work of mechanical equipment properly according to the instruction manual if given.	4.30	High

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Item	Statement	Score Mean	Level
C4	I can organize work activities effectively in terms of time and operational costs.	4.29	High
C5	I can identify mechanical operation problems related to machines and work equipment.	4.10	High
C6	I always make accurate and quick decisions during emergency situations.	4.16	High
C7	I can use statistical data in making decisions based on the analysis conducted.	4.15	High
C8	I can analyse problems from various aspects including the perception of people around or observing the environmental impact.	4.25	High
C9	I can find alternatives to problems effectively, creatively, and critically.	4.13	High
C10	I am proficient in using system planning software applications such as Ansys, AutoCAD, or SolidWorks.	4.10	High
C11	I can implement Industry Revolution IR4.0 elements, especially the Internet of Things (IoT) in problem-solving.	3.87	High
C12	I will use suitable applications in planning and monitoring work organizations such as Microsoft Project, Microsoft Planner, or Google Scheduling.	3.98	High
C13	I am proficient in using suitable software in data analysis such as SPSS, MATLAB, Abaqus, or Finite Element Method (FEM) software.	3.75	High
C14	I will solve problems in an environmentally friendly way such as using renewable energy	3.87	High
C15	I am able to comply with the environmental standards set by the authorities.	4.04	High
C16	I always support recycling programs such as properly separating waste or minimizing waste generation in daily activities.	4.22	High
C17	I always implement water saving practices, at work or at home continuously	4.48	High
	Average Mean Score	4.11	High

3.1.3 Core Competency Analysis Based on Behavioural Attitude

The researcher developed 11 items to assess students' behaviors related to the competency of mechanical executives in the sewerage sector. Table 6 shows that MTUN mechanical students have a high level of knowledge, with an average mean score of 3.98. This suggests that students believe their behaviors align well with working as mechanical executives. According to Table 6, the highest score is for item D13: "I can contribute positively to every group activity conducted," with a mean score of 4.3. The second-highest score is for item D10: "I can identify improvement opportunities by providing innovative solutions," with a mean score of 4.28. The lowest score is for item D5: "I am actively involved with professional networks in my field online, such as LinkedIn, The Institution of Engineers, Malaysia (IEM), or MBOT," with a mean score of 2.96. The second-lowest score is for item D4: "I have participated in networking events, industry conferences, or professional development activities," with a mean score of 3.33.

Table 6 *Level of competency based on student behavioural attitude*

Item	Statement	Score Mean	Level
D1	I am able to explain technical concepts perfectly and simply.	4.11	High
D2	I am able to understand information clearly and act according to the information received.	4.23	High
D3	I can perform documentation work well, clearly and in detail such as technical reports, e-mails or project plans.	4.04	High
D4	I have participated in networking events, industry conferences or professional development activities.	3.33	Moderate
D5	I am actively involved with online networks such as LinkedIn, The Institution of Engineers, Malaysia (IEM) or MBOT.	2.96	Moderate
D6	I can resolve conflict in a group diplomatically and positively.	3.85	High
D7	I am always responsible for all decisions made whether in a group or individually.	4.21	High
D8	I can identify opportunities for improvement by providing innovative solutions.	4.28	High
D9	I have empathy (the ability to understand other people's feelings) towards teammates.	4.22	High
D10	I can collaborate with teammates by sharing ideas in solving problems.	4.28	High
D11	I can contribute positively to every group activity conducted.	4.30	High
	Average Mean Score	3.98	High

Based on the findings, several aspects of students' interpersonal skills are at the highest level, while others are at a moderate level, which is interesting to discuss. The analysis found that items related to students' teamwork and leadership skills have the highest mean scores. Engineering and technology engineering students recognize that they can contribute positively in every group activity and can identify improvement opportunities by providing innovative solutions. This can be seen from the integration of project-based learning that requires students to work in teams to solve complex engineering problems (Jumaidin et al., 2023; Shahruddin Mahzan et al., 2021). This helps enhance communication, collaboration, and problem-solving skills.

In ensuring that the operation and maintenance of sewerage systems are carried out efficiently and effectively, it is important for workers to master leadership and teamwork skills (Ministry of Human Resources, 2023). According to Halili et al. (2022), these two skills are crucial employability skills not only in the sewerage sector but also in an individual's career. However, emphasis should be placed on communication skills and professional networking, as several items in this aspect are at a moderate level. This is because, although the mechanical engineering curriculum has integrated communication skills, students may perceive technical skills as more important than communication and professional networking skills. This perception can reduce their motivation to actively develop communication skills. According to Sabil et al. (2021), students should step out of the confines of their institutions; instead, active and extensive involvement in industry activities, external institutions, and communities can enhance the quality of a student.

3.1.4 Core Competency Analysis Based on Habitual Behaviour

The researcher developed 10 items to assess students' knowledge in the sewerage sector. As shown in Table 7, the analysis indicates that students at MTUN have a high level of knowledge, with a mean score of 4.30. This suggests that mechanical students believe their work habits for becoming mechanical executives are strong. According to Table 7, the highest score is for item E7: "I always complete tasks or work on time," with a mean score of 4.37. The second-highest score is for item E9: "I have a deep interest in the field of engineering or the job I will choose," with a mean score of 4.34. The lowest score is for item E1: "I will complete tasks according to the given timeframe," with a mean score of 4.16. The second-lowest score is for item E4: "I always set realistic task goals within a suitable timeframe," with a mean score of 4.25.

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Table 7 *Level of competency based on student habitual behaviour*

Item	Statement	Score Mean	Level
E1	I will complete the task according to the given time.	4.16	High
E2	I always handle the pressure if there is a toss-up.	4.32	High
E3	I can prioritize tasks between important or not based on the priority and importance of the task.	4.32	High
E4	I always set realistic task goals within a reasonable timeframe.	4.25	High
E5	I always maintain consistency in completing tasks or instructions given.	4.29	High
E6	I am always on time when doing tasks or work.	4.37	High
E7	I have a deep interest in the field of engineering or work to be chosen.	4.34	High
E8	I always maintain integrity in every decision made in every situation.	4.33	High
E9	I hold fast to praiseworthy virtues such as responsibility, honesty, trust, and courage.	4.31	High
E10	I can make difficult decisions based on the interests of society rather than individual interests alone.	4.34	High
	Average Mean Score	4.30	High

Based on the findings, mechanical students at MTUN are aware that their habitual behavior for working as a mechanical executive in the sewerage sector is at a high level. This is due to their strong commitment to their work, such as having a deep interest in engineering or the chosen job and consistently being punctual when completing tasks or work. This is because the programs at their institutions include professional development programs that encompass Interpersonal skills. These programs include courses in project management, professional ethics, and communication skills tailored to industry needs (Shahruddin Mahzan et al., 2021). According to Guilherme (2019), commitment to work is crucial in developing proactive and innovative workers capable of solving various problems and challenges in all aspects of their job. Additionally, these mechanical students recognize that their ethics, morals, and professionalism are at a high level and must be maintained in their conscience as they enter the workforce. The application of professional ethics and morals such as respect, integrity, and fairness can significantly impact the well-being and performance of an institution, individuals, and society (Ambarsari & Syarif, 2018).

However, these mechanical students also acknowledge the need to focus on completing tasks within the given timeframe and setting realistic goals within a suitable timeframe, as these areas, despite being at a high level, were the lowest in the study conducted. This is because the respondents have a heavy workload with many technical courses requiring significant time and effort, especially during their final year of study. Students may find it challenging to manage their time effectively when faced with multiple tasks and projects simultaneously. Emphasizing time management skills is essential not only in the professional sector but also in daily human life (Lukianova et al., 2019). Good time management can prevent various issues such as burnout or severe fatigue from different aspects, including emotional and physical, which can hinder an individual's work capabilities (Sarhaddi et al., 2019). According to Gresakova and Chlebikova (2021), managing workload through effective time management can create a positive work environment and help carry out core tasks efficiently.

3.1.5 Competency Analysis Between Programmes Based on Technical Skills and Interpersonal Skills

The researcher applied an independent samples t-test to analyse the differences in competency regarding technical skills, as the data distribution is normal. The researcher hypothesized that there would be no significant difference between the technical skills of mechanical engineering students and those in mechanical engineering technology, denoted as Ha0. According to the table, the results of the study indicate a significant difference, t (187) =3.175, p=0.002, concerning the differences in technical skills between engineering and technology students.

Since the p-value (0.002) is less than the level of significance (α = 0.05), means that Ha0 is rejected, indicating a significant difference in the mean technical skill levels between mechanical engineering students and those in mechanical engineering technology, with mechanical engineering students demonstrating higher technical skill levels. However, the effect size for both skill areas overall and specifically is small, with d=0.26, respectively.

The researcher also employed the Mann-Whitney U test to analyse the differences in competencies related to interpersonal skills due to the non-normal distribution of the data. According to the analysis detailed in Table 8, the mean ranks reveal a difference between the two groups concerning Interpersonal skills for students in Mechanical Engineering and Engineering Technology at MTUN. The findings indicate that mechanical engineering students (mean rank 106) have a higher mean rank compared to engineering technology students (mean rank 87.27). The higher mean rank signifies that this group possesses superior Interpersonal skills. Therefore, the mean score for Interpersonal skills for mechanical engineering students shows a significant difference compared to that of engineering technology students, with U=3471, p=0.02, and r=-0.169, indicating a small effect size.

Table 8 *The differentiation of competency and technical skills between programmes*

Variable		Mean Score	*t*	*df*	*p*	*d*
Technical Skills	Mechanical Engineering	4.18	3.175	187	0.002	0.26
	Mechanical Engineering Technology	4.06				
Interpersonal Skills	Mechanical Engineering	4.18	3471	-2.32	0.02	-0.169
	Mechanical Engineering Technology	4.06				

According to Buniyamin (2021), mechanical engineering differs from mechanical engineering technology in that engineering focuses on theory, including research work, complex analysis, intricate design, development, as well as testing and evaluation. In contrast, the technical work of engineering technology emphasizes the application of theory, encompassing product design, manufacturing, and production. Given the differences in components between these two fields of study, it is reasonable that the findings of this study reveal a disparity in competencies, particularly in the technical skills of mechanical students. This is also consistent with the job scope of a mechanical executive in the sewage sector, which involves similar components found in mechanical engineering, such as designing, evaluating, installing, operating, or maintaining mechanical products, equipment, systems, or processes to meet the standards required by the sector (Ministry of Human Resources, 2023). Therefore, improving, and diversifying methods of enhancing students' technical skills is essential, as it serves as a benchmark for their success in the careers they wish to pursue, especially within the sewage sector.

Furthermore, regarding interpersonal skills, there is a difference between the two academic programs in terms of their habitual behaviours and attitudes. The findings from the analysis indicate that mechanical engineering students possess higher Interpersonal skills compared to their engineering technology counterparts. However, the size of the difference in Interpersonal skills between these two programs is small, highlighting the need to enhance the Interpersonal skills of all mechanical students at MTUN. According to the Ministry of Human Resources (2023), additional skills required for working in the sewage sector, such as communication skills, leadership abilities, workload management, and working under pressure, are essential, particularly for mechanical executive roles. Overall, the results of this study successfully address the objective of examining the competency differences between mechanical engineering and engineering technology students, as supported by Haslina Hassan (2023). Nevertheless, the differences in competencies, both in technical and interpersonal skills, are small, and it is not unusual for engineering technology students to work as mechanical executives.

4. Conclusion

Overall, based on the analysis of the study findings, it can be concluded that the competency level of mechanical students to work as mechanical executives in the sewerage sector is high in all aspects, including their technical and Interpersonal skills. However, emphasis should be placed on existing knowledge in their field of study and their behaviour in the workplace. The combination of these two aspects is crucial to ensure effectiveness and success in the rapidly growing mechanical industry. Education and training in the mechanical field should equally emphasize the development of technical and Interpersonal skills, especially in mechanical engineering and mechanical engineering technology programs, despite the significant differences between these two programs. Comprehensive education programs should include practical and theoretical training, as well as opportunities to develop Interpersonal skills through co-curricular activities, group projects, and industrial training. With this

approach, graduates will be better prepared to face workplace challenges and contribute effectively to their organizations. With commitment from all parties, we can ensure that the workforce in the mechanical field is not only technically proficient but also possesses the Interpersonal skills needed to face future challenges and contribute to the advancement of the industry and society. In conclusion, the study has successfully achieved its objectives as stated in the introduction. Improving competency in both technical and Interpersonal skills in the mechanical field requires collaborative efforts from various parties to address issues of unemployment and skill mismatches in this rapidly developing industry.

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Conflict of Interest

There is no conflict of interests regarding the publication of the paper at any journals.

Author Contribution

The authors confirm contribution to the paper as follows: Muhammad Nur Hanafi Harolanuar: ***Literature review, methodology, data collection and project administration****. Faizal Amin Nur Yunus, Arasinah Kamis, Haryanti Mohd Affandi:* ***Drafted the manuscript and provided substantial revisions formal analysis, and validation. Contributed to writing the results and discussion sections, conceptualization, methodology and resources****. Azman Hussin:* ***Conceptualization and resource****.*

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